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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Amir Faghri et al.

Application No.: 10/632,440

Confirmation Number: 2836

Filed: July 31, 2003

Art Unit: 1745

For: MICRO HEAT PIPE EMBEDDED BIPOLAR
PLATE FOR FUEL CELL STACKS

Examiner: John S. Maples

DECLARATION OF AMIR FAGHRI UNDER 37 C.F.R. § 1.132

I, Amir Faghri, declare as follows:

1. I am the first named inventor on the above-referenced patent application.
2. I am the Dean of the School of Engineering of the University of Connecticut.
3. I hold the United Technologies Endowed Chair Professorship in Thermal-Fluids Engineering.
4. My education, experience, publications and other matters are described in my curriculum vitae ("CV"), a copy of which is attached hereto.
5. As is evidenced by my CV, through the course of my career, I have obtained extensive experience working with heat pipes. I am listed as an inventor on 11 U.S. patents – many of which are directed to heat pipe technology. These patents are listed on page 14 of my CV.
6. I authored a textbook, titled Heat Pipe Science and Technology, ISBN: 0-8403-6802-X. Since its publication in 1995, this textbook has become the leading text in heat pipes. As a result of its popularity, it will be reprinted in June 2006. The book contains 858 pages.

7. The new book, entitled *Transport Phenomena in Multiphase Systems*, being published by Elsevier, contains 11 chapters, 1012 pages, 403 figures, 292 problems and 62 examples.
8. I am listed as an author on over 150 journal articles. These articles are generally directed to heat pipes or other topics in thermal-fluid systems.
9. I currently hold editorial positions on seven (7) journals directed to thermal-fluids engineering, as shown on page 10 of my CV.
10. In summary, I consider myself to be an expert in thermal-fluids systems, particularly heat pipes.
11. I have had a chance to review the rejection mailed May 17, 2006 in the above-referenced patent application as well as the prior art relied upon by the Examiner in rejecting the claims.
12. I believe that the rejections of the claims in this patent application are based on an unsound factual foundation.
13. Specifically, I believe that the main flaw in the rejections arises from a misunderstanding of what a heat pipe is. The rejections appear to be based on the notion that a closed passage with a fluid passing through it constitutes a heat pipe. This notion is incorrect.
14. For example, in US 2003/0152821 ("Lisi"), it was asserted that the tubular members 102 defining passageways 116 and channels 112 are heat pipes. Tubular members 102 are not heat pipes at all. Instead, passages 102 are fluid flow passages forming a portion of an active cooling system.

15. US 2004/0146771 ("Saito") and US 2003/0152488 ("Tonkovich") do not remedy the deficiencies of Lisi. Specifically, Saito describes a fuel cell separator 1 having a number of ribs 1a that define passages 4 to permit the supply and discharge of hydrogen or oxygen. (Saito, ¶4, Fig. 1). Likewise, Tonkovich is generally directed to laminated devices including micro heating and cooling channels.

16. A heat pipe, on the other hand, is fundamentally different from conventional cooling tubes and from the teachings of Lisi, Saito and Tonkovich. Specifically, a heat pipe generally includes a sealed body containing a working fluid, at least one evaporator section disposed in the sealed body, and at least one condenser section. The heat pipe is typically configured to transport heat by evaporating working fluid in the evaporator section, and directing the working fluid from the evaporator section to the condenser section where the working fluid is condensed. Using a heat pipe in a fuel cell to distribute heat presents certain advantages over prior art systems.

17. First, by using a heat pipe, it is possible to achieve passive cooling in a fuel cell structure without the need for active cooling. This is an extremely valuable advantage.

18. Second, use of a heat pipe typically results in an order of magnitude of improvement in performance as compared to a conventional active cooling system, due to phase change. This improvement flows from: (a) high effective thermal conductivity; (b) potential use as a thermal transformer to link energy sources and sinks having different heat fluxes; (c) simple application in power flattening; (d) constant temperature control; (e) design freedom to fit various shapes and configurations; (e) maintenance-free operation for long periods.

19. The rejections in this case are also based on a publication that I co-authored with Khrustalev in 1995 as well as a publication of Z.J. Zuo. These publications are directed to certain aspects of heat pipes. In my view, there is no teaching or suggestion in these documents to combine them with any of the art mentioned above (Lisi, Saito and Tonkovich) to arrive at the invention claimed in the above-referenced patent application. In fact, there are certain compelling reasons why this is not obvious at all.

20. First, as mentioned above, Lisi operates off of a principle of conventional active cooling. Therefore, modifying Lisi to incorporate a heat pipe in lieu of its conventional tubular members 102 would really change the principle under which Lisi operates. I therefore conclude that Lisi is not analogous art. It is my further view that Saito and Tonkovich do not remedy this deficiency, and are also not analogous to the invention in this patent application.

21. In addition, in my opinion, there is no teaching or suggestion in the prior art or within the knowledge of one of ordinary skill in the art of fuel cells to combine a heat pipe with a fuel cell as described in this patent application.

22. In my view, I would say that a person of ordinary skill in the fuel cell art would have at least a bachelor's degree in chemical or mechanical engineering or other pertinent discipline, and one or more years of experience working with fuel cells. I believe that a person at this skill level would not have the requisite knowledge or motivation to combine the prior art relied on by the Patent Office in rejecting the claims to arrive at the invention described in this patent application.

23. I have been working with heat pipes and fuel cells for quite some time. Frankly, if it were so obvious to use a heat pipe in a fuel cell as described in my above-referenced

patent application, I should think that I would have thought of it much earlier, or that someone else in the field would have thought of it. However, this did not occur.

24. From my perspective, there has been a long felt, but unresolved, need for passive thermal management in fuel cells to make them more efficient and more commercially attractive. In my view, use of a heat pipe in a fuel cell to passively manage heat helps to provide a solution for this need.

25. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of any patent issuing from this patent application.

May 23, 2006
Date

Amin Faghri
Amin Faghri